Name: ________________________________ Date: ________________

Polynomial Operations SOLUTION (version 143)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) \;=\; 4x^5 - 8x^4 + x^3 - 10x^2 + 9$$

$$q(x) \;=\; -6x^5 + 3x^4 - 2x^2 - 8x - 7$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (4)x^5 + (-8)x^4 + (1)x^3 + (-10)x^2 + (0)x^1 + (9)x^0 \\
q(x) &= (-6)x^5 + (3)x^4 + (0)x^3 + (-2)x^2 + (-8)x^1 + (-7)x^0 \\
p(x) + q(x) &= (-2)x^5 + (-5)x^4 + (1)x^3 + (-12)x^2 + (-8)x^1 + (2)x^0 \\
p(x) + q(x) &= -2x^5 - 5x^4 + x^3 - 12x^2 - 8x + 2
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) \;=\; -2x^2 + 6x - 9$$

$$b(x) \;=\; -3x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-2x^2$	$6x$	-9
$-3x$	$6x^3$	$-18x^2$	$27x$
-4	$8x^2$	$-24x$	36

$$a(x) \cdot b(x) \;=\; 6x^3 - 18x^2 + 8x^2 + 27x - 24x + 36$$

Combine like terms.

$$a(x) \cdot b(x) \;=\; 6x^3 - 10x^2 + 3x + 36$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 143)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -3x^3 + 17x^2 - 10x + 4 \\ g(x) &= x - 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-3	17	-10	4
5		-15	10	0
	-3	2	0	4

So,

$$\frac{f(x)}{g(x)} = -3x^2 + 2x + \frac{4}{x-5}$$

In other words, $h(x) = -3x^2 + 2x$ and the remainder is $R = 4$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -3x^3 + 17x^2 - 10x + 4$. Evaluate $f(5)$.

You could do this the hard way.

$$\begin{aligned} f(5) &= (-3)\cdot(5)^3 \ + \ (17)\cdot(5)^2 \ + \ (-10)\cdot(5) \ + \ (4) \\ &= (-3)\cdot(125) \ + \ (17)\cdot(25) \ + \ (-10)\cdot(5) \ + \ (4) \\ &= (-375) \ + \ (425) \ + \ (-50) \ + \ (4) \\ &= 4 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(5)$ equals the remainder when $f(x)$ is divided by $x - 5$. Thus, $f(5) = 4$.